

system, is then recorded by computer-generated curves as a function of time. If the collecting system is dilated but not obstructed, at least 50% of the activity will wash out from the collecting system by 15 minutes after intravenous administration of the furosemide. This study is relatively noninvasive and provides results that correlate well with those of the Whitaker test.

If enough renal parenchymal disease is present to limit the ability of the kidney to increase its urine flow in response to diuretics, the furosemide renogram could be falsely positive for partial obstruction and this constitutes the major limitation of the technique. In the presence of dilated collecting system(s), by expanding the study to a furosemide renogram it will be possible to differentiate obstructive from nonobstructive uropathy. In most cases this will obviate the need for a confirmatory Whitaker test.

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### Indium 111-Labeled Leukocyte Scanning

LEUKOCYTE SCANNING using indium 111 is now established as a valuable technique for detecting acute inflammatory processes. Accurate identification and non-invasive localization of abdominal and occult abscesses are the primary indications for doing this study. It has been proved conclusively that the <sup>111</sup>In-labeled leukocytes retain their viability and function while concentrating avidly in areas of abscess and inflammation. The labeling technique is simple and efficient and can be incorporated into most nuclear medicine departments. Both autologous and heterologous cells have been used successfully. The radiolabeled leukocytes are not excreted through the bowel or kidneys, which offers a significant advantage over gallium 67 scanning. The study is generally completed within 24 hours, and large series consistently report sensitivities, specificities and accuracies greater than 90%. The <sup>111</sup>In-labeled leukocyte scan is most valuable in a patient suspected of harboring an abscess or an acute inflammatory process without focal signs or symptoms. A negative result is strong evidence against the presence of a significant inflammatory process, while a positive result can expedite diagnosis and therapy.

The areas of greatest clinical use thus far include suspected abdominal abscesses without focal signs to indicate their location, postoperative patients, occult abscesses outside the abdomen, inflammatory bowel disease and bowel infarction. Conditions in which the leukocyte scan has proved to be less useful include pyelonephritis, bone and joint disorders (with the possible exception of acute osteomyelitis), bacterial endocarditis and fungal, parasitic and chronic infections. Success with <sup>111</sup>In-labeled leukocytes has stimulated

research to evaluate their possible use in interstitial lung disease, rheumatic diseases and vascular infections.

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### Hepatobiliary Scintigraphy in the Diagnosis of Acute Cholecystitis

WITHIN THE past few years a new class of technetium 99m-labeled radiopharmaceuticals has evolved and revolutionized the diagnostic examination of patients who may have acute cholecystitis. Loosely referred to as "HIDA" (the US Pharmacopeial Convention code designation for lidofenin), these compounds have become the standard for hepatobiliary imaging. Of the HIDA compounds, diethyl-iminodiacetic (IDA) and diisopropyl-IDA have been found most satisfactory because of their comparatively better pharmacokinetics and decreased fractional renal excretion.

Patients appropriately selected for HIDA scans are those suspected of having acute cholecystitis because of typical signs and symptoms of the disorder, including right upper quadrant abdominal pain, fever, leukocytosis and so forth. After a negative history of cholecystectomy is obtained and the patient has fasted for two hours, HIDA is injected and images taken serially with a scintillation camera for up to two hours if necessary. A normal gallbladder will appear 30 minutes to an hour later. If the gallbladder does not appear, cystic duct obstruction and associated cholecystitis are inferred. From reported series (including more than 1,000 patients) the sensitivity and specificity in this study exceed 95% even with serum total bilirubin levels of up to 4 mg per dl.

Certain cautions are advisable in inferring cholecystitis from HIDA scans. A loss in specificity, which may be considerable, can occur under some circumstances. For instance, the test has been found to be undependable in poorly nourished patients, especially in those who have alcoholism, those persons subjected to fasting of more than one day's duration (such as patients receiving long-term intravenous hyperalimentation) and in patients with total serum bilirubin levels of greater than 4 mg per dl.

A comparison between ultrasonography and HIDA scans in diagnosing acute cholecystitis has led to animated discussions, but with the above cautions, a substantial majority of experts agree that HIDA scans are superior to ultrasonography in spite of an approximate 20% cost savings of the latter. This is because ultrasonographic characteristics of acute cholecystitis are nonspecific—that is, not all patients with gallstones have acute cholecystitis; also, the cystic duct may be blocked without stones identified in the gallbladder by ultrasonography. Additionally, ultrasound studies can-